MOULT IN BABBLERS (*TURDOIDES* spp.)[1]

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Key words: whiteheaded babbler, jungle babbler, post-juvenal moult, body feathers, primaries, secondaries, rectries, breeding and moult, duration.

The juvenile Whiteheaded Babbler *Turdoides affinis* and the Jungle Babbler *Turdoides striatus* undergo partial moult beginning at 3 months after fledging. This moult is complete only in the birds fledged in the early part of the year. In others, the late developing feathers are retained. They undergo a complete moult in the next year. In both the species, there is only one annual moult, and they breed and moult simultaneously. The body feathers start moulting from March to November in the Whiteheaded Babbler and from February to November in the Jungle Babbler. In both species, moult of body feathers proceeds at a slow tempo. Primaries moult from a single focus from late April to October/November in both the species. In both the species secondaries moult from two foci, the tertiaries, irregularly, and the rectrices centrifugal.

Babblers of the genus *Turdoides* live in groups and breed co-operatively. In the Calicut University Campus, these birds breed throughout the year with a lull in July, the month of heaviest rainfall (Gaston *et al.* 1979). They breed and moult simultaneously. The Whiteheaded Babbler *Turdoides affinis* and the Jungle Babbler *T. striatus* co-exist in several parts of South India. The former prefers open dry scrub habitat, while the latter frequents woody areas. We studied the biology of these species of babblers (Zacharias and Mathew 1988) in the Calicut area from 1974 to 1980. An account of their moult is given here.

Materials and Methods

Specimens of the Whiteheaded Babbler and the Jungle Babbler were collected by shooting at a rate of 5-10 per month. The specimens collected for analysis of stomach contents were preserved in 10% formalin or 70% alcohol. All the specimens were collected near the Chelannur area of Calicut and Thenhippalam village of Malappuram. These two areas had the same type of climate, physiographic conditions and layout of crops. Specimens of the two babblers were collected for studying various aspects of biology by different workers over a period of 3 years from a vast area of about 240 sq. km. Particular care was taken to see that no group of babblers was repeatedly used for collection; we very frequently changed sites of collection. These specimens were used for the doctoral theses on ecology and biology by the first author, leg myology and pterylography by Dr. K.V. Jayashree and for two M. Phil. dissertations on comparative appendicular myology by Elizabeth Stephen and Lija Thomas. The remaining specimens were preserved carefully and used for other studies as and when required. After other studies were conducted they were dried in the laboratory and the feather tracts examined carefully. Information on the state of plumage in the birds collected over three years from 1975-1977 was pooled. Data collected from the examination of the plumage of the birds trapped for ringing and those ringed as nestlings, were also used for studying the moult.

Details of moult were recorded on cards. Moult in the body feathers was estimated by counting the number of moulting feathers out of a sample of 30 feathers each in all the body tracts every month. In the humeral, femoral and crural tracts, which had very few feathers the entire tracts were examined to estimate the percentage of feathers moulting. The system and symbols used by Stressemann and Stressemann (1966) were followed for numbering and naming the remiges and rectrices.

Results

Whiteheaded Babbler

Post-juvenal moult: The juvenile undergoes

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a partial or complete moult of its feathers starting about three months after fledging. The post-juvenile moult begins in the frontal region of the capital tract or with the first primary. We did not see any post-juvenile moult between October and April. In many juveniles which fledged late in the year, the dormant papillae of the late developing feathers started proliferating just before or during the post-juvenile moult. It is presumed that some of these were retained during the post-juvenile moult, if they moulted in the year of hatching, and moulted completely if they moulted in the next season. We have not examined a large sample of juveniles to draw any definite conclusion about the above aspect. The feather coat in both the species of babblers never changes colour and there is no sexual dimorphism.

Adult body feathers: In the Calicut area, moult of the adult body feathers in the Whiteheaded Babbler started in March, beginning in the frontal region of the capital tract. Moult of the body feathers was more intensive during the period September to October, but was otherwise a slow and long drawn process which ended in November. The dorsal and ventral tracts took the longest duration to complete renewal. At no time between March and November were more than 50% of the feathers of any of the regions counted moulting.

Primaries: There are ten primaries of which the outermost is the smallest. The moult of the primaries normally started in late April from the first primary and proceeded in the ascending order. Growing of two primaries simultaneously was the usual pattern. There were a few exceptional cases of 3-4 primaries growing simultaneously; these were noted towards the end of the moulting period of the primaries. Most birds had completed their primary moult by the end of October. Primary moult in the population thus covered about 6 months.

Secondaries: There are nine secondaries, of which the innermost is the smallest. The secondaries moulted from two foci i.e., from A1 and A6. The latter sometimes dropped only after A5 had moulted. The secondaries sometimes moulted simultaneously from both ends. Secondary moult usually started when the third primary (H3) was moulting and ended after H10 had been renewed. There were exceptional cases of the secondary moult starting and ending earlier than the beginning and end of primary moult respectively. The moult of tertiaries started in any of its three quills (A7-9). They moulted before, during or after the renewal of the other remiges.

Wing coverts: The upper greater primary coverts moulted in close coordination with their respective primaries. Moulting of several upper secondary greater coverts ahead of the renewal of the respective secondaries was a frequent occurrence.

Rectrices: There are 12 rectrices. The rectrices started moulting when H3 was growing and proceeded centrifugally. After the first pair had completed their growth, rectrices 2-6 moulted rapidly, sometimes as many as 3 pairs of rectrices grew simultaneously. In one third of the cases examined (N = 90) rectrix moult was symmetrical. The large number of cases of asymmetrical moult of rectrices was probably due to the accidental loss of these feathers. Moulting of rectrices was completed either before the completion of the primary moult or along with H10, but in 10% of the cases (N = 90), moulting of the tail feathers continued after the completion of the primary moult.

Alula: The alula was renewed during the span of the moult of the primaries. Alular quills moulted from the proximal to the distal end and in an orderly manner.

Relationship between moult and breeding: Eventhough a clearly marked breeding season was absent in *T. affinis*, two peak periods of egg laying were identified in March/April and November/December (Gaston *et al.* 1979, Zacharias and Mathew 1988). Females with developing eggs collected in May (2)[5], August (2), September (1) and October (1) were all moulting their remiges.

JUNGLE BABBLER

The moult of the Jungle Babbler was studied

[5] Number of females collected in each month are given in brackets.

TABLE 1
COMMENCEMENT AND COMPLETION OF PRIMARY MOULT IN
T. affinis and *T. striatus*

Stages of Primary Moult	Earliest recorded date		Last recorded date	
	T. affinis	*T. striatus*	*T. affinis*	*T. striatus*
Commencement of primary moult	April 26 (1)	April 20-26 (6)	June first week (4)	June 6 (1)
Completion of primary moult	September 28 (1)	August 27 (2)	November first week (4)	November first week (4)

The figures in brackets show the number of specimens examined.

by Naik and Andrews (1966) in Baroda (May to October/November) and by Gaston in Delhi (June-November). In our study area in Calicut *T. striatus* started moulting its body feathers from February. The frontal region of the capital tract was the first to moult. The flight feathers moulted between April and October.

Primaries: The primary moult was orderly, regular and symmetrical. It began in April and ended in November. Unilateral growth of primary feathers simultaneously, probably due to accidental loss of feathers of one wing and cases of 3-4 primaries growing together were also noted occasionally.

Secondaries: The secondaries moulted from both proximal and the distal foci. The sixth secondary and the tertiaries moulted at different times. In 12 out of 29 cases in which the beginning of the tertiary moult was recorded, A8 moulted ahead of A7 and A9. Of these 29, A9 moulted first in 8 specimens and A7 in nine. Secondaries started moulting simultaneously with the primaries in a few cases but usually only after the second primary had moulted. Usually the moult of the secondaries was not completed along with that of the primaries. The tertiaries moulted before, during or after the other remiges were renewed.

The upper greater wing coverts: The upper primary greater coverts moulted in co-ordination with their respective remiges. The secondary upper greater coverts moulted in bunches as in the Whiteheaded Babbler.

Alula: The tail feathers moulted from the centre to the periphery. Unilateral growing of the tail feathers of one side was noticed in four out of 72 cases of rectrix moult. In the rest, the tail feathers moulted symmetrically. Rectrices started moulting after H3 in some cases, but in 50% of the cases only when H3 was moulting. The tail coverts appeared to moult symmetrically. The rectrices completed moulting before the completion of the moult of the primaries or along with them.

Moult in relation to breeding: In our study area the Jungle Babbler bred throughout the year. There were records of egg laying by the birds in all the months except June and July. So moult of feathers and breeding activity in this species were not temporarily separated. The midpoint of the moult coincided with the period of lowest breeding in June and July.

COMPARISON OF MOULT IN THE WHITEHEADED AND THE JUNGLE BABBLER

The first complete moult: Both species undergo their first complete moult in their second year of life. Pattern of this moult and all subsequent moults are identical.

Duration of Moult: Table 1 gives the earliest and last cases of recorded commencement and completion of primary moult in the Whiteheaded and the Jungle Babbler. The moult of the primaries spans almost the entire moulting period. Using the method of Pimm (1976) the duration of primary moult at individual level was crudely estimated to be 16-20

weeks in both the babblers. Gaston (1981) described a shorter duration of primary moult in babblers and some other birds in Delhi. the duration of primary moult in Baroda was not worked out. But at the population level the primary moult in the Jungle Babbler began in May and ended in October/ November in Baroda (Naik and Andrews 1966). In Delhi it was from June to October (Gaston pers. comm.), while in Calicut it was from April to October/ November. In Sarawak, Fogden (1972) recorded the duration of primary moult of individual birds of 18 species, ranging from 17-20 weeks. The duration of moult in the Whiteheaded Babbler and the Jungle Babbler in the study area were slow, compared to temperate birds and some birds of seasonal tropics (Delhi), but similar to the duration for species of moist tropics.

Discussion

The pattern of moult of feathers of the Whiteheaded and the Jungle Babbler were very similar in several respects but differed from that of many other passerine birds. Their pattern of moult is well adapted to their way of life in the study area. As they breed irregularly throughout the year, they have no exclusive breeding and moulting seasons.

At the population level the primaries in the Jungle Babbler moulted from April to October/November, from May to October/ November in Baroda and from June to October in Delhi. The shorter duration of primary moult in Delhi may be related to the climatic conditions there — the severe summer and winter. In Calicut there are no severe extremes of climate except for the heavy rainfall in June-July.

As both breeding and moult of feathers are functions which demand much energy, it may be advantageous to renew feathers at a slow tempo, so that too much strain is not placed on the bird's energy budget at any particular period. In birds which have a breeding-moult overlap, the moult of feathers may be considerably protracted by means of a decrease in the number of feathers growing at any one time or in their rate of growth (Snow and Snow 1964, Newton 1966). Generally the pattern of moult of flight feathers in these two species of babblers agree with the general pattern (Stressemann and Stressemann, op. cit.) for passerine birds. The renewal of tertiaries at times different from the times of renewal of the rest of the remiges is an adaptive feature. According to Stressemann and Stressemann (1966), H7-9 act as guard feathers which cover the rest of the wing feathers in the closed wing. So they should not be weakened by moulting simultaneously with the rest of the feathers. The simultaneous renewal of several upper secondary coverts also should serve the same purpose. However the cases of tertiary moult examined are too few to establish their exact pattern of renewal.

Varying degrees of overlap between breeding and moulting activities were reported in many species of tropical birds like the common Babbler *T. caudatus* (Gaston 1966), the Indian Myna *Acridotheres tristis*, the Bank Myna *A. ginginianus*, the Brahminy Myna *Sturnus pagodarum* (Naik 1970) and the House Swift *Apus affinis* (Naik and Naik 1965).

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